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“Weekend Effect” or “Saturday Effect”?

An Analysis of Hospital Mortality for Patients With Ischemic Stroke in South Carolina

Most studies about the mortality difference between weekend and weekday admissions for acute stroke have used a weekend-versus-weekday dichotomy rather than exploring patterns of specific admit days.¹ Studies assessing this “weekend effect” categorize discharges to hospice care without distinction from other survivors, a questionable classification given the definition of hospice. We explored differences in hospital outcomes for acute stroke admissions by each day in the week.

We used the 2012 to 2013 State Inpatient Hospital Discharge Database (<http://rfa.sc.gov/healthcare/dataoversight/restricted>) for all acute ischemic stroke hospital admissions in South Carolina. This study was approved by the Clemson University Institutional Review Board. Patients discharged with a primary diagnosis of ischemic stroke were identified based on the following International Classification of Diseases-9-CM codes: 433.x1, 434.91, 434.11, 434.01, and 436.01.² The primary outcome was hospital mortality, labeled as “expired” for the discharge status. Among patients with nonfatal discharges, we performed further analyses of whether discharge was to hospice.

The key independent variable was the day of admission in the week. We calculated crude hospital mortality incidence for each day during the week and used Saturday admission as the reference. Admission on Saturday had the highest crude hospital mortality of all days (Table). For each of the 2 binary outcomes (fatal vs nonfatal discharge; and among nonfatal discharge, those discharged to hospice vs not), we ran multilevel logistic regression models to explore the associations between the admission day in the week (Saturday as the reference) and the outcomes, with hospitals as clustering units. We adjusted for patient age, sex, race/ethnicity, year and season of admission, payer type, and Charlson Comorbidity Index (CCI). For sensitivity analysis, we ran the same models with the weekend-versus-weekday dichotomous variable as the key independent variable, with weekend defined as admission on Saturday or Sunday.

A total of 20187 ischemic stroke events were identified, overall with 4.1% in-hospital mortality, 4.1% discharged to hospice, and 91.8% discharged otherwise. For hospital mortality and hospice discharge, Friday, Saturday, and Sunday admission days had higher crude incidence than the overall cohort (Table). There were 2174 ischemic stroke admissions on Saturdays and 2173 admissions on Sundays, compared with 3168 admissions on an average weekday. The average CCI of 1.85 among the weekday admissions was lower than the average CCI on Saturdays (CCI=2.01, $P<0.001$) and Sundays (CCI=1.99, $P<0.001$).

In logistic regression analyses, patients admitted on weekends versus weekdays had higher crude odds for mortality (odds ratio [OR] 1.21, 95% confidence interval [CI] 1.03–1.42) and higher odds of being discharged to a hospice facility (OR 1.33, 95% CI 1.13–1.58). Admissions on Sundays and every weekday except Fridays were associated with lower crude hospital mortality compared with Saturday admissions (Sunday: OR

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Key Words: hospital performance
■ mortality ■ stroke care

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Table. Discharge Status and “Weekend Admission Effect” Among Ischemic Stroke Patients in South Carolina, 2012 to 2013

| | Discharged as “Expired” (N=20 187) | | Discharged to Hospice Among Nonfatal (N=19 347) | |
|-----------|------------------------------------|-------------------------|---|-------------------------|
| | Unadjusted Rate | Adjusted Odds Ratios | Unadjusted Rate | Adjusted Odds Ratios |
| Weekend | 5.07% | 1.207* (1.027,1.420) | 5.06% | 1.333‡ (1.126,1.577) |
| Weekday | 3.90% | 1.00 (referent) | 3.72% | 1.00 (referent) |
| Sunday | 4.33% | 0.72* (0.55,0.96) | 5.62% | 1.12 (0.84,1.50) |
| Monday | 3.99% | 0.73* (0.57,0.95) | 3.34% | 0.72* (0.54,0.97) |
| Tuesday | 3.66% | 0.70† (0.54,0.90) | 3.07% | 0.66† (0.50,0.89) |
| Wednesday | 3.80% | 0.69† (0.53,0.90) | 3.72% | 0.84 (0.63,1.11) |
| Thursday | 3.67% | 0.66† (0.51,0.87) | 3.98% | 0.83 (0.63,1.11) |
| Friday | 4.42% | 0.78 (0.60,1.02) | 4.66% | 0.95 (0.72,1.26) |
| Saturday | 5.80% | 1.00 (referent) | 5.22% | 1.00 (referent) |
| Overall | 4.10% | NA | 4.08% | NA |

In the 2 multilevel logistic regressions, we control for age, sex, race/ethnicity, payer status, season of admission, admission year, and Charlson Comorbidity Index score, with hospital as the cluster variable. 95% confidence intervals in parentheses. NA indicates not applicable.

* $P<0.05$.

† $P<0.01$.

‡ $P<0.001$.

0.72, 95% CI 0.55–0.96; Monday: OR 0.73, 95% CI 0.57–0.95; Tuesday: OR 0.70, 95% CI 0.54–0.90; Wednesday: OR 0.69, 95% CI 0.53–0.90; Thursday: OR 0.67, 95% CI 0.51–0.87; Friday: OR 0.78, 95% CI 0.60–1.02). Compared with Saturday admissions, the crude odds of being discharged to hospice were lower for Monday and Tuesday admissions (Monday: OR 0.72, 95% CI 0.54–0.97; Tuesday: OR 0.66, 95% CI 0.50–0.89), whereas admissions on Sundays and other weekdays did not differ from Saturday admissions.

We found that ischemic stroke patients admitted on Saturdays had higher hospital mortality than Sunday admissions. Among nonfatal discharges, weekend admission was associated with higher odds of discharge to hospice, whereas Friday admission did not differ from weekend admission. Our finding that weekends had fewer admissions but higher average CCI than weekdays supports the hypothesis of a higher severity threshold for admission on weekends.³

Our data dating from 2012 to 2013 may not capture the latest progress in stroke care. Our dataset lacked information on admission hours to explore more detailed patterns such as diurnal change and transition time. Whether admissions on Friday evenings and Saturday mornings (hours of transition between weekday and weekend staff)

contributed to the high hospital mortality of Fridays and Saturdays is a hypothesis that will be further explored with stroke registry data. This is important, given a recent study that questioned the hypothesis that the difference between weekend and weekday staffing is the underlying cause for the mortality difference.⁴ Finally, our dataset did not have variables to build the National Institutes of Health Stroke Scale International⁵ as a stroke severity measure or the variables to control for the stroke admission rate of each day in each hospital we analyzed.

DISCLOSURES

None.

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FOOTNOTES

Circulation is available at <http://circ.ahajournals.org>.

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